

What Is Claimed Is:

1. A cooling system for brakes in an axle assembly comprising:
 - a) an air-oil cooler assembly;
 - b) at least one hydraulic pump, an output of the pump in communication with an inlet of the air-oil cooler assembly, at least a portion of the oil exiting an outlet of the air-oil cooler assembly adapted to cool the brakes of the axle assembly;
 - c) a hydraulic fan assembly adapted to circulate air past the air-oil cooler assembly, a fan of the fan assembly being driven by oil exiting the outlet of the air-oil cooler assembly;
 - d) a reservoir for receiving oil from the hydraulic fan and the brakes and for further recirculation to an inlet of the at least one hydraulic pump; and
 - e) a pump drive linked to a transmission of the axle assembly, output of the transmission driving the at least one hydraulic pump.
2. The system of claim 1, wherein the hydraulic fan assembly includes a control valve downstream of the air-oil assembly to receive a portion of the oil exiting an outlet of

the air-oil cooler assembly, the valve adapted to control the flow of oil to the hydraulic fan assembly for fan operation.

3. The system of claim 1, wherein the pump drive is linked to the transmission via an electric clutch, the electric clutch controlling driving of the pump drive by the transmission based on the direction of rotation of a shaft of the axle assembly.

4. The system of claim 3, wherein the electric clutch receives a signal from back-up lights of a trailer to disengage the transmission from the pump drive.

5. The system of claim 1, wherein the transmission operation is directly controlled electronically for driving the pump.

6. The system of claim 1, further comprising a temperature regulated bypass valve in communication with an outlet of the air-oil cooler assembly, the bypass valve controlling flow of oil to the hydraulic fan assembly based on a sensed temperature of the oil.

7. The system of claim 1, further comprising a divider downstream of the air-oil cooler assembly, the divider directing

oil to the brakes of the axle assembly and the hydraulic fan assembly.

8. The system of claim 1, further comprising a manifold collector adapted to receive oil from the brakes, hydraulic fan assembly for return to the reservoir.

9. The system of claim 1, wherein a pair of hydraulic piston pumps are used, and the output of the pumps is split to a pair of brake cooling inlets on the axle assembly.

10. A method of cooling brakes in an axle assembly comprising:

a) providing at least one hydraulic pump and driving the at least one hydraulic pump using a rotation of the shaft of the axle assembly;

b) directing oil exiting the at least one hydraulic pump to an air-oil cooler assembly to reduce the temperature of the oil;

c) directing at least a portion of the oil exiting the air-oil cooler assembly to brakes of the axle assembly; and directing another portion of the oil exiting the air cooler assembly to a hydraulic fan assembly to drive a hydraulic fan thereof and circulate air across the air-oil cooler assembly; and

d) accumulating the oil exiting the brakes and hydraulic fan assembly in a reservoir for recirculation to the at least one hydraulic pump.

11. The method of claim 10, wherein the pump is driven by a transmission linked to the axle assembly.

12. The method of claim 11, wherein the transmission is deactivated when the shaft is to rotate in a direction opposite of the direction of rotation that drives the pump.

13. The method of claim 10, further comprising sensing a temperature of the oil being pumped, and directing the another portion of the oil exiting the air cooler assembly to the hydraulic fan assembly to drive the hydraulic fan thereof to circulate air across the air-oil cooler assembly when the temperature reaches a certain target temperature.

14. The method of claim 11, wherein the pump is directly linked to the transmission, or is linked by an electrical or mechanical clutch.

15. In a trailer having an axle assembly supporting rear wheels thereof, the axle assembly including brake assemblies for the wheels, the improvement comprising using the system of claim 1 as the axle assembly and brake cooling system.

16. The trailer of claim 15, wherein the trailer is a lowboy trailer having a front end hitch capable of connecting to a removable gooseneck hitch of a towing vehicle.

17. A braking cooling assembly comprising an axle assembly, a transmission for the axle assembly, and the cooling system of claim 1.

18. The assembly of claim 1, further comprising a trailer, wherein at least one axle assembly/transmission is mounted on a rear end of the trailer.

19. In an axle assembly having brakes that require cooling, the improvement comprising at least one hydraulic pump that supplies cooling oil to the brakes and means for driving of the hydraulic pump using rotation of a component of the axle assembly, and a heat exchanger assembly adapted to receive heated oil from the brakes for cooling and recirculation back to the brakes.